REMARKS

Claims 1, 2, 4-11, 13 and 14 are pending. Claims 3 and 12 have been canceled without prejudice or disclaimer. Claims 1, 2, 4 and 13 have been amended. The abstract has been replaced with a new abstract.. The specification has been amended. No new matter is presented.

The drawings were objected to due to various informalities. The drawings have been corrected and substitute drawings for Figs. 1, 3, 5, 6 and 7 are being submitted herewith. Accordingly, Applicant requests that this objection be withdrawn.

The abstract was objected to because it contained the term "means" and for other informal reasons. The abstract has been replaced with a new abstract. Accordingly, Applicant requests that this objection be withdrawn.

The title of the invention was objected to because it was not descriptive. The title has been amended. Applicant requests that this objection be withdrawn.

The disclosure was objected to under 37 CFR 1.71 as being so incomprehensible s to preclude a reasonable search of the prior art by the Examiner. The Examiner cites various instances of confusion relating to the disclosure. The specification has been amended to clarify the invention. Care was taken not to add new matter. In addition, Applicant offers the following explanation of the invention for clarification purposes only and respectfully requests that all remaining objections be withdrawn.

Detection position 33 merely acts to couple the light which is reflected by the SOS mirror 34 to the optical fiber 11. The light is coupled by the detection position 33 and enters the optical fiber without any modification by the detection position 33. In the case of the first embodiment, the wavelength ($\lambda 1$) of the light is converted by the wavelength converter to a wavelength $\lambda 2$. In the case of the second embodiment, since the light which is eventually used as the synchronization signal comes from the laser diode 15, rather than from diode 7, that light is already at a wavelength of $\lambda 2$, so it does not need to be converted by a wavelength converter. Referring again to the first embodiment, after the light is converted by wavelength converter 35, the

light of wavelength $\lambda 2$ is transmitted to the combiner 400 and then transmitted to combiner 12 through the optical fiber 11. After the light has passed through the combiner 12, it is transmitted to the photosensor 13 (see Figs. 2 and 5). The photosensor 13 converts the light to an electrical signal. This electrical signal is input to the microcomputer 61. Applicant has found that the term "synchronization signal" was used improperly in certain instances of the disclosure. Care has been taken to amend the disclosure to clarify this matter. Applicant notes that only the electrical signal which is transmitted from photosensor 13 to the microcomputer 61 should be referred to as the synchronization signal. Applicant believes that the foregoing explanation and amendments should clarify the application to allow a proper search by the Examiner. However, if the Examiner believes further explanation is necessary, Applicant respectfully requests that the Examiner telephone the undersigned to discuss the application in further detail.

The claims have been amended to coincide with the foregoing explanation and to overcome any objections by the Examiner. Applicant requests that the objections to the claims be withdrawn.

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of the claims and to pass this application to issue.

In the event that the transmittal letter is separated from this document and the Patent and Trademark Office determines that an extension and/or other relief is required, applicant petitions for any required relief including extensions of time and authorizes the Commissioner to charge the cost of such petitions and/or other fees due in connection with the filing of this document to **Deposit Account No. 03-1952** referencing 325772025700.

Dated: June 9, 2003

Respectfully submitted,

By Deborah S. Gladstein

Deborah S. Gladstein
Registration No.: 43,636
MORRISON & FOERSTER LLP
1650 Tysons Blvd, Suite 300
McLean, Virginia 22102
(703) 760-7700
Attorneys for Applicant

Amendments to the Title:

Replace the existing title with the following rewritten title:

IMAGE FORMING APPARATUS USING A SINGLE OPTICAL FIBER TO TRANSMIT ELECTRICAL SIGNALS

Amendments to the Specification

Replace paragraph 0031 on page 8 with the following rewritten paragraph:

A1

[0031] The drawing control unit 6 is provided with a microcomputer 61, image memory 63, and clock generating circuit 62. Print data such as text transmitted in ASCII code or the like are converted to dot ON/OFF information, i.e., raster data, for each one line using the image memory 63, and horizontally synchronizing light transmitted from the print engine 5 is combined by the combiner 12, input to the photosensor 13, and input to the microcomputer 61 as an electrical signal after photoelectric conversion in the photosensor 13~~, and~~ . The electrical signal input to the microcomputer 61 drives the laser diode driver 8 in accordance with the raster data of each single scan (see Fig. 2).

Replace paragraphs 0038-0043 on pages 10-13 with the following rewritten paragraphs:

A2

[0038] FIG. 4 is a perspective view showing the essence of the image forming unit 10 of the first embodiment. The photosensitive drum 21 has on its surface a photosensitive layer 22, and is rotated in the arrow a direction in the drawing by the drum motor 23. A charger 25 is provided at the surface of the photosensitive drum 21, and uniformly charges the surface of the photosensitive layer 22 appearing before the sensor in conjunction with the rotation of the photosensitive drum 21. ~~A horizontal synchronizing signal and combined light are~~ An optical signal L and combined light are emitted from the exit end by a combiner 400 provided at the end on the output side of the optical fiber 11.

[0039] ~~An~~ The emitted optical signal L passes through a condensing lens 26, and is deflected by a optical scanning means 27, and this optical signal L irradiates (scans) the photosensitive layer 22 along the axial direction of the photosensitive drum 21. The charged state of the surface of the photosensitive layer 22 is changed by the irradiation of the laser light, and a latent image is formed. A developing device 28 is provided downstream of the position irradiated by laser light on the photosensitive drum 21, and a visible image is developed by toner adhered to the formed latent image.

[0040] The optical scanning means 27 is rotated, for example, in the arrow b direction, at constant high speed by the polygonal mirror motor 30, and the output optical signal is reflected by each surface of a polygonal mirror 31, and scans the photosensitive layer 22 at equal speed via an fθ lens 32. Part of the reflected light from the polygonal mirror 31 is reflected by an SOS mirror 34, and impinges the detection position 33 of the horizontal synchronizing signal~~, and the light impinging this detection position 33~~ . The detection position 33 couples the light reflected by the SOS mirror to the wavelength converter 35 and is subjected to wavelength conversion by ~~a~~ the wavelength converter 35~~, and~~ . The converted light then impinges the combiner 400. The light output from the combiner 400 is directed through the optical fiber 11 to the video controller 3.

Cont A2

[0041] FIG. 5 briefly shows the basic structure of bi-directional communication of light. The output of the laser diode 7 oscillating the ~~image~~ optical signal and emission light used to obtain the ~~horizontal synchronizing signal at a~~ light of wavelength λ1 passes through the combiner 12, and is transmitted through optical fiber 11 to the print engine 5 side. The transmitted light passes through the combiner 400 on the printer engine 5 side and is emitted from the exit end 41a. The light emitted from the exit end 41a forms a latent image on the photosensitive layer 22 as previously described.

[0042] The light of wavelength λ1 ~~input~~ reflected to the detection position 33 ~~of the horizontal synchronizing signal~~ is converted to a wavelength λ2 by a wavelength converter 35, passes through the combiner 400, and is transmitted through the optical fiber 11 in the reverse direction to the video controller 3 side. The transmitted light of wavelength λ2 passes through the combiner 12, is subjected to photoelectric conversion by the photosensor 13, and is input as an electrical signal (synchronizing signal) to the microcomputer 61. Based on this operation, the light of wavelength λ1 used for image drawing is oscillated by the laser diode 7 so as to match the image timing on the print engine 5 side.

[0043] In this way, the raster signal (light) and optical signal used for the horizontal synchronizing signal are transmitted from the video controller 3 side to the print engine 5 side over the same optical fiber 11, and ~~a~~ the synchronizing signal is generated by the optical signal, which was reflected by polygon mirror 31 and then by SOS mirror 34 to ~~used for the horizontal~~

~~synchronizing signal impinging~~ the specific detection position 33 from the print engine 5 side, and the synchronizing signal (light of wavelength λ2) is transmitted in the reverse path over the optical fiber 11 to the video controller 3 side. By performing wavelength conversion at this time, part of the light of wavelength λ1 from the video controller 3 side is reflected to the video controller 3 side as the synchronizing signal of wavelength λ2, but since the wavelengths are different, these signals can be reliably separated.

Cont'd A2

Replace paragraphs 0047-0050 on pages 14-15 with the following rewritten paragraphs:

A3

[0047] Although, in the first embodiment, the radiation light (of wavelength λ1) used to obtain a synchronizing signal is generated by the same laser diode 7 ~~as~~ which generates the ~~raster~~ optical signal L, in the second embodiment, ~~this~~ the light (of wavelength λ1) used to obtain the synchronizing signal is generated by ~~another~~ a different laser diode, i.e., a synchronization laser diode 15.

[0048] FIG. 7 is a perspective view showing the essence of the image forming unit 10 of the second embodiment. Since the formation of the latent image and visible image on the photosensitive drum 21 is identical to that of the first embodiment (FIG. 4), it is not described, however, the second embodiment differs in that the signal transmitted through the optical fiber 11 to the print engine 5 side includes a light signal used to generate ~~for~~ the synchronization signal. For this reason, a laser diode 15 different from the laser diode 7 for generating ~~raster signals~~ light, is provided facing the polygonal mirror 31 at a position nearly identical to the condensing lens 26.

[0049] Light emitted with a suitable timing from the synchronization laser diode 15 is reflected by the polygonal mirror 31, and is reflected by the SOS mirror 34 only when the polygonal mirror 31 is at a fixed rotational angle position, and reaches the detection position 33. A synchronizing signal is generated when the light reaches the detection position 33 and is coupled to the optical fiber 11~~, and raster signal generation starts directly with this index or at a suitable time~~.

[0050] FIG. 8 briefly shows the basic structure of bi-directional communication of light in the second embodiment. The second embodiment is similar to the first embodiment in that the laser

Cont'd A3

diode 7 only generates an image signal (raster signal), and this raster signal passes through the combiner 12, and is transmitted to the print engine 5 side over the optical fiber 11 and ultimately forms a latent image on the photosensitive layer 22, but differs in that the synchronizing signal (light) of wavelength $\lambda 2$ is generated by ~~another~~ synchronization laser diode 15.

Replace paragraph 0052 on page 15 with the following rewritten paragraph:

A4

[0052] FIG. 9 is a timing chart showing the timing of the actuation of the synchronization laser diode 15 and the actuation of the image laser diode 7 for generating raster signals in the second embodiment. The synchronization laser diode 15 continuously emits light until the horizontal synchronizing signal can be first detected (indicated by the circle in FIG. 9), and when the horizontal synchronizing signal is obtained, a timer (time ~~t1~~ ti) runs based on this signal, the image region is detected, and the image laser diode 7 emits light in accordance with an image signal. Furthermore, another timer (time ts) runs based on the horizontal synchronizing signal, to obtain a timing for emission by the synchronization laser diode 15 for obtaining the horizontal synchronizing signal.

Amendments to the Abstract:

Replace the Abstract with the following rewritten Abstract.

ABSTRACT OF THE DISCLOSURE

~~To provide an~~ An image forming apparatus is provided which not only transmits optical signals of image information and optical signal for synchronizing from the video controller to the print engine using a single optical fiber and without using a special synchronization optical fiber, but also transmits a synchronizing optical signal reflected by the SOS mirror on the print engine side simultaneously in the reverse path to the video controller, such that the number of lines are reduced in the layout, external noise and emitted noise are reduced, and the interior of the image forming apparatus is consolidated making handling and assembly easier. ~~In an image forming~~ The apparatus ~~provided with a transmitting means for transmitting~~ transmits optical signals over an optical fiber, ~~and an optical scanning means for scanning~~ scans a photosensitive drum via a beam emitted from the optical fiber and ~~detecting~~ detects the beam at a detection position disposed outside the image region, and ~~synchronizing~~ synchronizes the main scan direction based on the detected beam.

This listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims:

A5

Claim 1 (currently amended). An image forming apparatus comprising:

an optical fiber;

a transmission device connected to the optical fiber, the transmission device transmitting optical signals over the optical fiber;

an optical scanning device connected to the optical fiber, the optical scanning device emitting an optical beam;

a synchronizing device connected to the optical fiber, the synchronizing device detecting the optical beam in a detection area, ~~and~~ transmitting ~~a synchronizing signal~~ the detected optical beam over the optical fiber, and generating a synchronizing signal in response to the detected optical beam.

Claim 2 (currently amended). The image forming apparatus according to claim 1, further comprising a wavelength converting device converting a wavelength of the ~~detect~~ detected optical beam.

Claim 3 (canceled)

Claim 4 (currently amended). The image forming apparatus according to claim ~~3~~ 1, wherein bi-directional communication is established over the optical fiber between the transmission device and the optical scanning device.

Claim 5 (original). The image forming apparatus according to claim 4, wherein the optical scanning device scans an object in an image area using the emitted optical beam.

Claim 6 (original). The image forming apparatus according to claim 5, further comprising a reflecting device reflecting the optical beam from an area adjacent the image area, the reflected optical beam being reflected to the detection area.

Claim 7 (original). The image forming apparatus according to claim 6, wherein the reflecting device is a SOS mirror.

Claim 8 (original). An image forming apparatus comprising:

a transmission device sending optical signals over an optical fiber; and

Cont A5

an optical scanning device scanning an object using an optical beam emitted from the optical fiber, detecting the optical beam at a detection position provided outside an image region, and synchronizing a main scan direction based on the detected beam;

wherein a synchronizing optical output of the detected optical beam is subjected to a wavelength conversion by a wavelength converting device, and bi-directional communication is accomplished using the optical fiber transmitting the optical signals.

Claim 9 (original). The image forming apparatus according to claim 8, further comprising a reflecting device reflecting the optical beam from an area adjacent to the image region to the detection position.

Claim 10 (original). The image forming apparatus according to claim 9, wherein the reflecting device is a SOS mirror.

Claim 11 (original). An image forming apparatus comprising:

a transmission device sending optical signals over an optical fiber;

a synchronizing optical output device emitting a synchronizing optical output, wherein a synchronizing wavelength of the synchronizing optical output is different from a signal wavelength of the optical signals transmitted by the transmission device; and

an optical scanning device scanning an object using an optical beam emitted from the optical fiber, detecting the optical beam at a detection position outside an image region, detecting the synchronizing optical output, and synchronizing a main scan direction based on the detected synchronizing optical output;

Cond A5

wherein bi-directional communication is accomplished over the optical fiber transmitting the optical signals by the transmission device and the optical scanning device.

Claim 12. (canceled)

Claim 13 (currently amended). The image forming apparatus according to claim ~~12~~ 11, further comprising a reflecting device reflecting the optical beam at the detection position, the reflected optical beam being reflected towards the optical scanning device.

Claim 14 (original). The image forming apparatus according to claim 13, wherein the reflecting device is a SOS mirror.

Amendments to the Drawings:

The attached sheets of drawings include changes to Figs. 1, 3, 5, 6 and 7. These sheets replace the original sheets for Figs. 1, 3, 5, 6 and 7.

Attachment: Five replacement sheets